



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.02.2000 Bulletin 2000/05

(51) Int. Cl.⁷: **C02F 1/48, F02M 27/04**

(21) Application number: **99305988.0**

(22) Date of filing: **28.07.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
 Designated Extension States:
AL LT LV MK RO SI

(72) Inventors:
 • **McClenaghan, Brent**
Blackpool, Lancashire, FY1 6LY (GB)
 • **Timms, Nigel David**
St. Annes, Lancashire FY8 2JX (GB)

(30) Priority: **28.07.1998 GB 9816332**

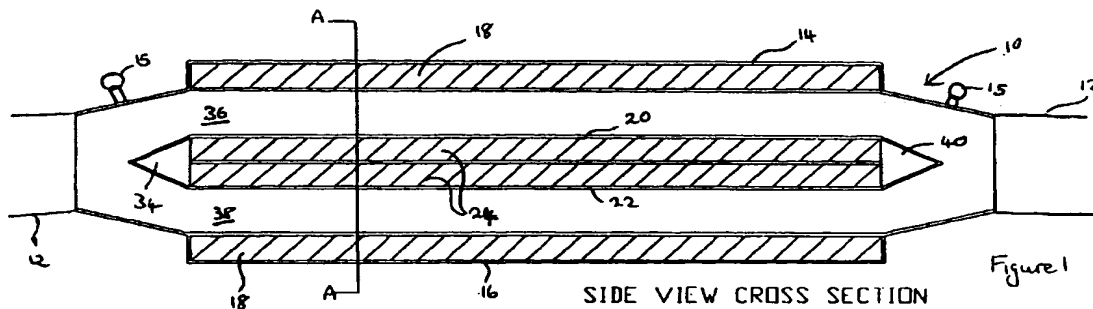
(74) Representative:
Chugg, David John et al
Appleyard Lees,
15 Clare Road
Halifax, West Yorkshire HX1 2HY (GB)

(71) Applicant: **MITech UK Ltd.**
Blackpool, Lancashire FY1 1PD (GB)

(54) **Magnetic treatment of fluids**

(57) A magnetic fluid treatment device (10) is arranged to be fitted in line with a fuel supply pipe (12) and comprises upper and lower peripheral box sections (14) and (16) respectively into which a plurality of magnets (18) are inserted. The fuel treatment device (10) also comprises upper and lower central box sections (20) and (22), into which further magnets (24) are

inserted. Fuel flowing through the magnetic fuel treatment device (10) on its way to a fuel combustion point or the like is affected by the magnetic fields of the magnets (18) and (24), which results in a more efficient burning process.



Description

[0001] This invention relates to apparatus for the magnetic treatment of fluids and to a method of treating fluids magnetically, particularly, but not limited to, apparatus and a method for the magnetic treatment of fuels.

[0002] The magnetic treatment of fuels is used to increase the combustion efficiency of the fuel. Magnets are placed around a fuel pipe, thereby subjecting the fuel within the pipe to a magnetic field, and the fuel is subsequently combusted. The mechanism by which the combustion efficiency of the fuel is increased is not well understood, but the effect has been utilised to good effect.

[0003] Also, other fluids such as water can be treated magnetically, to keep salts in suspension. It is known that tomatoes, for instance, have greater yields when irrigated with magnetically treated water.

[0004] Previous apparatus for magnetising fossil fuels has involved simply securing a pair of magnets or other arrangements at an angular separation of approximately 90° on a fuel pipe. This results in the magnetic field only extending into a portion of the fuel pipe because the field does not extend across the pipe but rather through a small sector thereof. Thus, the field is not perpendicular to flow of fluid. Disadvantages arise with this type of device because the fuel passing through the fuel pipe is not all magnetised. Furthermore, placing magnets on the outside of a fuel pipe becomes very inefficient with fuel pipes having a diameter of approximately 5cms or above, since the magnetic field passes through a smaller proportion of the fuel because of attenuation of the field.

[0005] It is an object of the present invention to address the above mentioned disadvantages.

[0006] According to one aspect of the present invention a magnetic fluid treatment device comprises a plurality of fluid channels, each fluid channel having at least one peripherally located magnet; the device cooperating with a fluid supply conduit, so that, in use, fluid flowing through the fluid channels is subjected to a magnetic field.

[0007] The magnet fluid treatment device may be a magnetic fuel or fossil fuel treatment device, in which case the fluid channels are fuel channels and the fluid supply conduit is a fuel supply conduit.

[0008] The fluid channels may be water channels.

[0009] The plurality of fluid channels may be formed by subsidiary channels of at least one major channel. The or each major channel may be subdivided by internal magnets located within the or each major channel. The internal magnets may be contained in a housing, which may, in use, prevent contact between the magnets and fluid in the channels. The housing may be a box section, preferably a box section of metal which contains and/or isolates magnetic fields.

[0010] The device may include at least one flow direc-

tor between adjacent subsidiary channels to improve the flow of fluid therethrough by smoothly splitting or joining the flow of fluid. The or each flow director may have a tapered cross-section. Preferably, flow directors are included at leading and trailing ends of the subsidiary channels.

[0011] The or each peripherally located magnet may be held in position by retaining means.

[0012] The fluid channels may be located within an external housing. The external housing may comprise a plurality of sections which are arranged to be secured together to enclose the fluid channels. Preferably the external housing comprises first and second sections.

[0013] The first and second sections may be arranged to have a central section secured therebetween. Preferably, the central section comprises the fluid channels and a plurality of internal magnets.

[0014] The or each peripherally located magnet may be held in position by retaining means of the external housing. The retaining means may be at least one flange which forms a slot with a wall, preferably an interior wall, of the external housing, into which slot the peripherally located magnet may be inserted. The external housing may be made of metal that will isolate and/or contain magnetic fields, such as ferritic steel or electric steel.

[0015] The device may comprise attachment means at each end, which may be externally threaded or flanged portions, or similar attachment means to facilitate connection of the device to the fluid supply conduit.

[0016] The device may include at least one pressure sensing means which may be located at an end of the device. Preferably, the device includes pressure sensing means at both ends of the device.

[0017] Preferably, the magnetic field is applied substantially at right angles to the flow of fluid.

[0018] The magnets may be arranged to have first, like poles facing inwardly towards the central axis of the channels at a first, leading end of the device. Preferably the magnets are arranged at either side of the channels. The magnets may be arranged to have second, like poles facing inwardly towards the central axis of the channels at a second, trailing end of the device. The magnets may be arranged to have opposite poles facing inwardly towards the central axis of the channels in a central section of the device. The sense of the first like poles may be chosen depending on the fluid to be used. Alternatively, the magnets may be arranged to have opposite poles facing inwardly towards the central axis of the channels along the length of the device.

[0019] At least one of said fluid channels may contain a catalyst, preferably a tin alloy catalyst, to improve the combustion efficiency of fuel flowing therethrough. The catalyst may be held in position in a mesh bag. The catalyst may be held in position in the fluid channel(s) by retaining members extending across the channels, which retaining members may have a plurality of openings therein, to assist the passage of fuel therethrough.

The retaining members may be mesh. One retaining mesh may be located upstream and one retaining mesh may be located downstream of the catalyst.

[0020] According to another aspect of the present invention a method for magnetically treating fluid comprises passing the fluid through a plurality of fluid channels of a fluid treatment device, each fluid channel having at least one peripherally located magnet, the fluid thereby being subjected to a magnetic field.

[0021] The fluid may be fuel, preferably fossil fuel, in which case the fluid channels are fuel channels and the fluid treatment device is a fuel treatment device.

[0022] The method may include subdividing the flow of fluid by means of magnets located within a major channel of the device, which magnets may thereby create subsidiary channels.

[0023] According to a still further aspect of the present invention, a magnetic fluid treatment device comprises at least one fluid conduit around which are arranged a plurality of magnets, wherein the magnets are arranged to have first, like poles facing inwardly towards a central axis of the or each channel at a first region of the device, second, like poles facing inwardly towards the central axis of the or each channel at a second region thereof, and opposite poles facing inwardly towards the central axis of the channels in a third region located between the first and second regions.

[0024] According to a still further aspect of the present invention, a magnetic fluid treatment device comprises at least one fluid conduit around which are arranged a plurality of magnets, wherein the magnets are arranged to have opposite poles facing inwardly towards a central axis of the or each channel.

[0025] All of the above aspects may be combined with any of the features disclosed herein, in any combination.

[0026] Specific embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic sectional side view of a first embodiment of magnetic fuel treatment device;

Figure 2 is a sectional view across the line A-A in figure 1;

Figure 3 is a diagrammatic sectional top view of a second embodiment of magnetic fuel treatment device;

Figure 4 is a diagrammatic sectional side view of the second embodiment of magnetic fuel treatment device;

Figure 5 is a diagrammatic sectional view across the line A-A in figure 4;

Figure 6 is a diagrammatic sectional top view of a

third embodiment of magnetic fuel treatment device;

Figure 7 is a diagrammatic sectional view across the line A-A in figure 6;

Figure 8a is a schematic view of a first arrangement of magnets in a fuel treatment device;

Figure 8b is a schematic view of a second arrangement of magnets;

Figure 8c is a schematic view of a third arrangement of magnets;

Figure 9a is a diagrammatic sectional side view of a further embodiment of fuel treatment device; and

Figure 9b is a cross sectional end view of figure 9a.

[0027] A magnetic fuel treatment device 10 is arranged to be fitted in line with a fuel supply pipe 12 and comprises upper and lower peripheral box sections 14 and 16 respectively into which a plurality of magnets 18 are inserted. The fuel treatment device 10 also comprises upper and lower central box sections 20 and 22, into which further magnets 24 are inserted. Fuel flowing through the magnetic fuel treatment device 10 on its way to a fuel combustion point or the like (not shown) is affected by the magnetic fields of the magnets 18 and 24, which results in a more efficient burning process.

[0028] The fuel treated can be fossil fuel, such as oil and gas or equivalent fuel types.

[0029] In more detail, the magnetic fuel treatment device 10 comprises upper and lower portions 26 and 28 (see figure 2) which include the upper and lower peripheral box sections 14 and 16 respectively. A central portion 30 is secured between the upper and lower portions 26 and 28. The central portion 30 comprises a section of pipe 32 having a circular cross section and the upper and lower central box sections 20 and 22. The upper and lower portions 26 and 28 and the central portion 30 are secured together by means of bolts 34.

[0030] The magnetic fuel treatment device 10 may be made of ferritic steel or electric steel generally termed magnetic containment steel, which is chosen because it does not become magnetised over time. Metals having similar properties could also be used.

[0031] Returning to figure 1, the upper and lower central box sections have a leading flow director 34, which serves to channel fuel flowing through the magnetic fuel treatment device 10 into upper and lower channels 36 and 38 and to ensure a smooth flow of the fuel. A corresponding trailing flow director 40 is included at the opposite end of the upper and lower central box sections 20 and 22.

[0032] The use of the various box sections 14, 16, 20 and 22 into which the magnets 18 and 24 are inserted

allows for easy assembly of the magnetic fuel treatment device 10, because the magnets 18 and 24 can be slid into position before the various portions of the fuel treatment device 10 are secured together. This has particular advantages in the situation that like poles of the magnets 18 and 24 are to be placed adjacent to each other within the box sections 14, 16, 20 and 22, because the magnets strongly repel each other and would be prone to suddenly flip out of alignment. Arranging the magnets so that like poles are adjacent to each other can have beneficial effects for the magnetic treatment of the fuel.

[0033] The upper and lower channels 36 and 38 preferably have a maximum width which is less than 5cms. Consequently, the fuel in a fuel pipe having a bore of between 7.5 and 10cms, for instance, can be treated efficiently with the magnetic fuel treatment device 10 disclosed herein, without any disadvantageous effects of the fuel not being treated because of a lack of magnetic field affecting the fuel.

[0034] The upper and lower central box sections 20 and 22 which contain the magnets have a further beneficial effect over simply placing the magnets within the fuel pipe itself, which is that flakes of the magnet will not be released into the fuel which would be the case if the magnets were not enclosed. Consequently, clogging of the fuel burner due to flakes of magnet in the fuel is avoided.

[0035] The magnets used may include the following types: ceramic grades 1, 2 and 3; anisotropic ferrite; samarium cobalt 1:5-2:17; neodymium N27-N50. The magnets may have Gauss values in the range 200-13,000.

[0036] A second embodiment of magnetic fuel treatment device 50 is shown in figures 3 to 5. The fuel treatment device 50 is arranged and constructed in a very similar way to the fuel treatment device 10, except that this fuel treatment device 50 has twin pipe sections 32 each having their own upper and lower peripheral box sections 14 and 16, and upper and lower central box sections 20 and 22. The second embodiment of fuel treatment device 50 has all of the features of the first embodiment, with the addition of forward and rear flow directors 52 and 54 respectively, which serve to direct the flow between the two adjacent pipe sections 32.

[0037] The second embodiment has the additional advantage of allowing still smaller widths of channel 36 and 38, giving the required magnetic effect for treating fuel. Alternatively, larger bore fuel pipes can have the fuel efficiently treated by the magnets 18 and 24, because there are twice as many magnets 18 and 24 compared to the first embodiment - thus extending the treatment time of the fluid.

[0038] A third embodiment of magnetic fuel treatment device 60 is shown in figures 6 and 7. The structure of the device is similar to the second embodiment of fuel treatment device 50 except that the upper and lower central box sections 20 and 22 are not present, resulting

in the two pipe sections 32 forming open channels 62, through which fuel may pass. The third embodiment has the forward and rear flow directors 52 and 54 present in the second embodiment. The third embodiment of fuel treatment device 60 is easier and cheaper to manufacture than the first two embodiments.

[0039] The magnetic field is preferably applied to the fuel at about 90° to the direction of flow.

[0040] In all embodiments, the arrangement of the magnets 18 and 24 within the box sections 14, 16, 20 and 22 can be chosen to further increase the efficiency of burn of the fuel in the fuel pipe, depending on the type of fuel used. Figures 8a and 8b show possible arrangements which have been found to be beneficial for gas and oil respectively. Figure 8c shows a further configuration.

[0041] In figure 8a the magnets are arranged so that the gas entering the fuel treatment device 10 first encounters a first set of magnets 70 which have their north poles facing in towards the channels 36 and 38. A second set of magnets 71 have one north pole and one south pole facing into each of the channels 36 and 38. A third set of magnets 72 have their south poles facing in towards the channels 36 and 38.

[0042] In figure 8b the order of the magnets is reversed from that shown in figure 8a. The first set of magnets 70 has south poles facing in towards the channels 36 and 38 the second set 71 is the same as figure 8a, but the third set 72 has north poles facing in towards the channels 36 and 38.

[0043] In Figure 8c the magnets are arranged so that the fluid entering the device 10 encounters sets of magnets to which have opposite poles facing in towards the channels 36 and 38.

[0044] The arrangements of magnets shown in figures 8a and 8b can be altered to reflect a longer fuel treatment device 10. In this case, the first, second and third sets of magnets 70, 71 and 72 may comprise adjacent magnets 18 and 24 having the same alignment of poles ie. two magnets 18 together having their north poles facing inwards for the first set of magnets 70, followed by a pair of adjacent magnets having the same orientation for the second set 71 and the third set 72 having adjacent magnets having the south poles facing inwards towards the channels 36 and 38. Further combinations of the alignment of the poles and the magnets can also be envisaged within the scope of the invention.

[0045] A further embodiment of fuel treatment device is shown in figures 9a and 9b. This embodiment includes a catalyst 39 which can be a tin alloy catalyst containing tin, antimony, lead and mercury for improving fuel combustion efficiency. The catalyst is held in the fuel channels 36 and 38, either in a mesh bag (not shown) or between mesh retaining members 37. Catalysts are known to improve fuel combustion efficiency. The provision of a catalyst within the fuel channels does not significantly affect throughflow whilst providing a very compact fuel treatment device.

[0046] The above embodiments have referred to the use of fuel in the fuel treatment device 10. If water, or other fluids, are fed through the device, it is also known that beneficial yields of plants and crops etc are achieved. Consequently, without departing from the scope of the invention the fuel treatment devices may be fluid treatment devices.

[0047] The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0048] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0049] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0050] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A magnetic fluid treatment device comprises a plurality of fluid channels, each fluid channel having at least one peripherally located magnet; the device cooperating with a fluid supply conduit, so that, in use, fluid flowing through the fluid channels is subjected to a magnetic field.
2. A magnetic fluid treatment device as claimed in claim 1, in which the fluid channels are fuel channels and the fluid supply conduit is a fuel supply conduit.
3. A magnetic fluid treatment device as claimed in any preceding claim, in which the plurality of fluid channels are formed by subsidiary channels of at least one major channel.
4. A magnetic fluid treatment device as claimed in claim 3, in which the or each major channel is subdivided by internal magnets located within the or each major channel.

5. A magnetic fluid treatment device as claimed in claim 4, in which the internal magnets are contained in a housing, which, housing, in use, prevents contact between the magnets and fluid in the channels.
6. A magnetic fluid treatment device as claimed in any preceding claim, in which the fluid channels are located within an external housing.
7. A magnetic fluid treatment device as claimed in any preceding claim, in which the magnets are arranged to have first, like poles facing inwardly towards the central axis of the channels at a first, leading end of the device.
8. A magnetic fluid treatment device as claimed in any preceding claim, in which at least one of said fluid channels contains a catalyst, to improve the combustion efficiency of fuel flowing therethrough.
9. A magnetic fluid treatment device as claimed in claim 8, in which the catalyst is held in position in the fluid channel(s) by retaining sections extending across the channels.
10. A method for magnetically treating fluid comprises passing the fluid through a plurality of fluid channels of a fluid treatment device, each fluid channel having at least one peripherally located magnet, the fluid thereby being subjected to a magnetic field.
11. A magnetic fluid treatment device comprises at least one fluid conduit around which are arranged a plurality of magnets, wherein the magnets are arranged to have first, like poles facing inwardly towards a central axis of the or each channel at a first region of the device, second, like poles facing inwardly towards the central axis of the or each channel at a second region thereof, and opposite poles facing inwardly towards the central axis of the channels in a third region located between the first and second regions.
12. A magnetic fluid treatment device comprises at least one fluid conduit around which are arranged a plurality of magnets, wherein the magnets are arranged to have opposite poles facing inwardly towards a central axis of the or each channel.

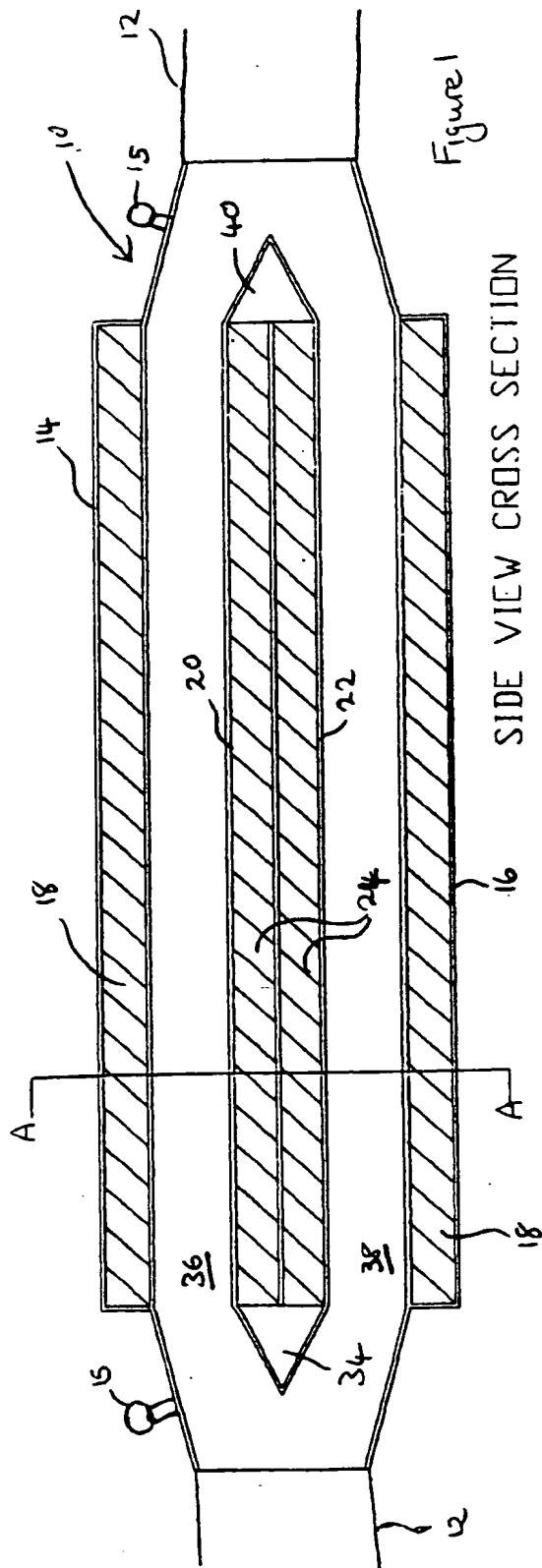


Figure 1

SIDE VIEW CROSS SECTION

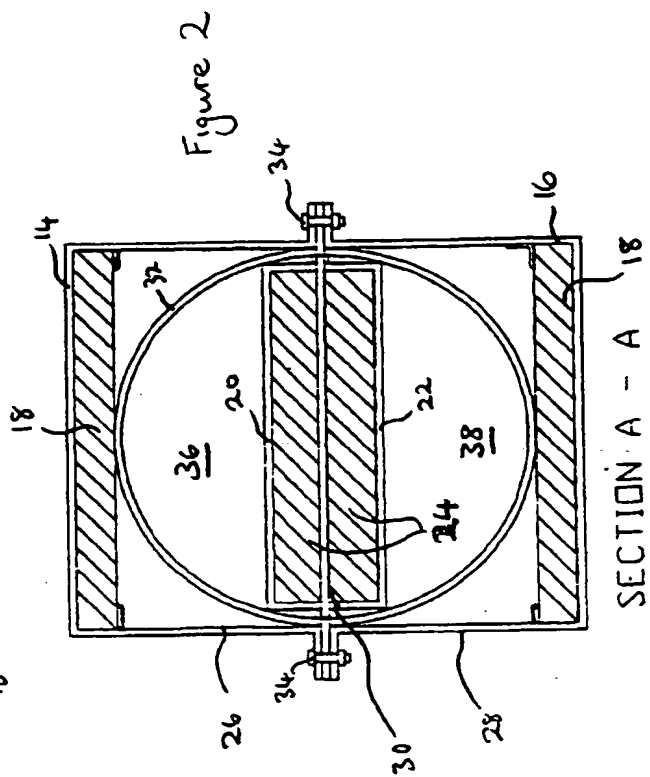


Figure 2

SECTION A - A

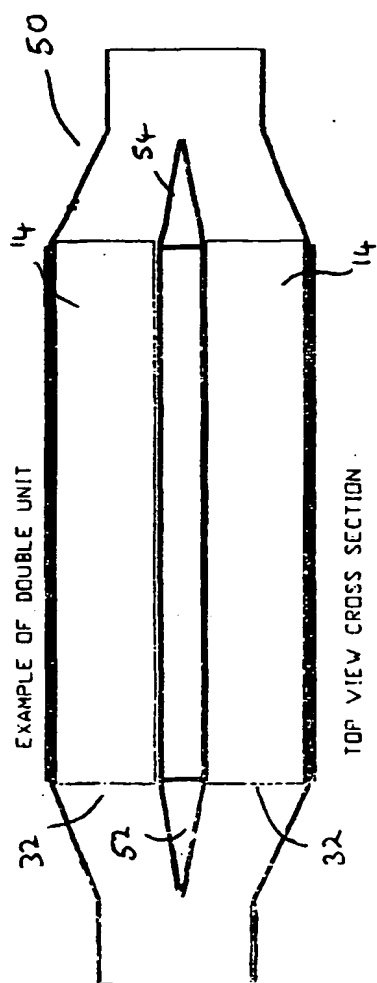


Figure 3

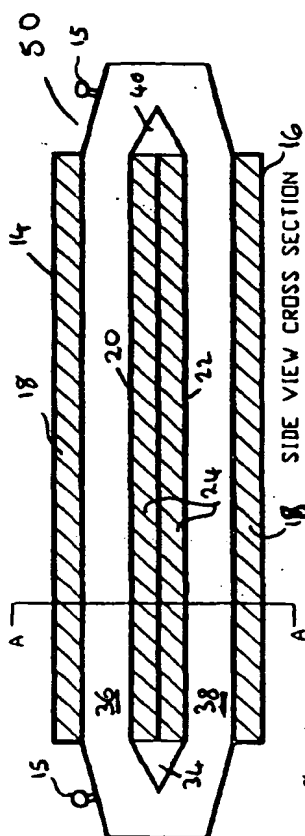


Figure: 4

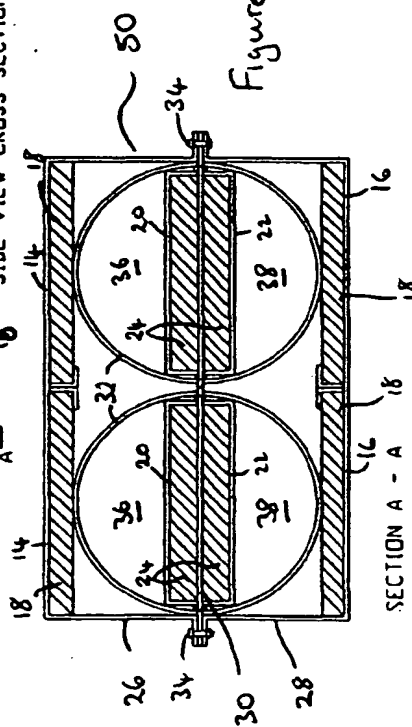


Figure 5

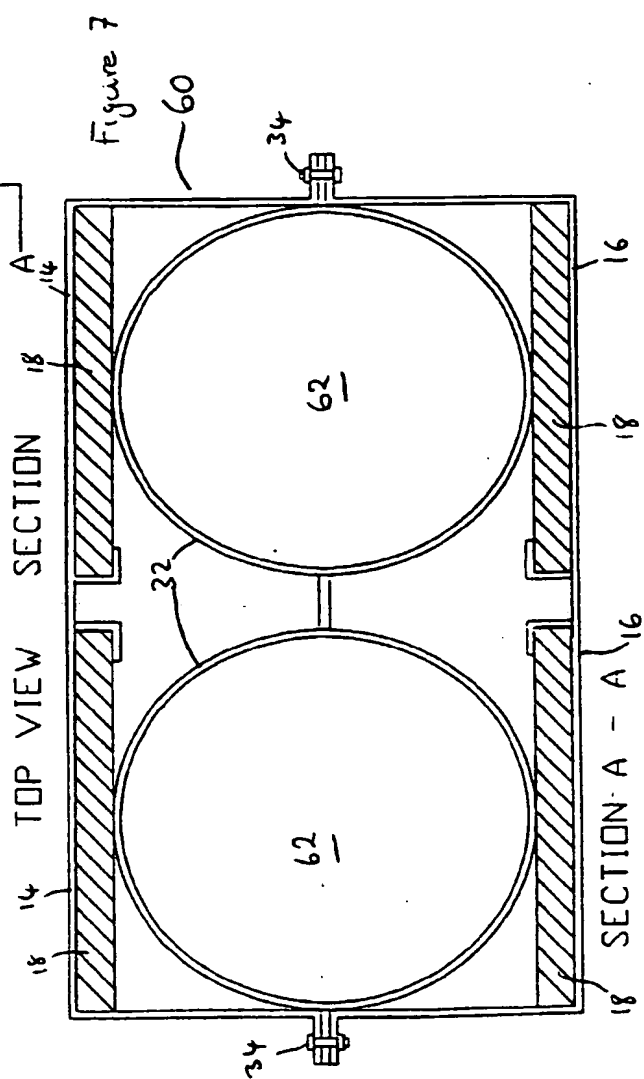
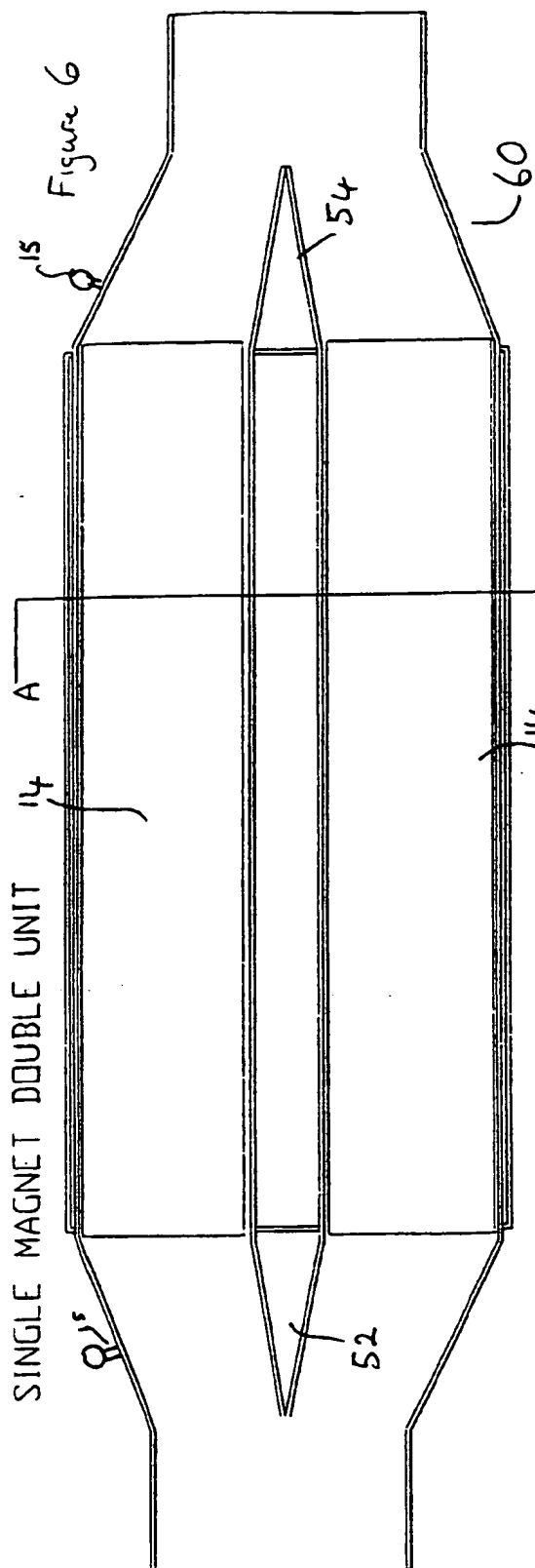


Figure 8A

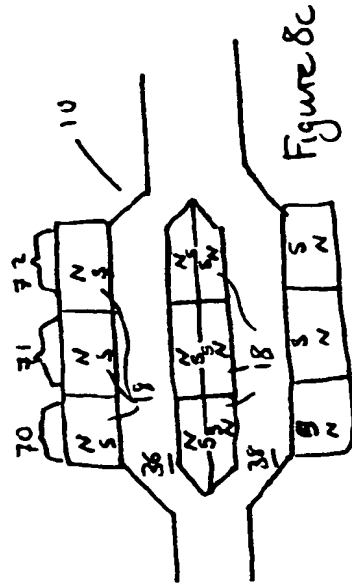
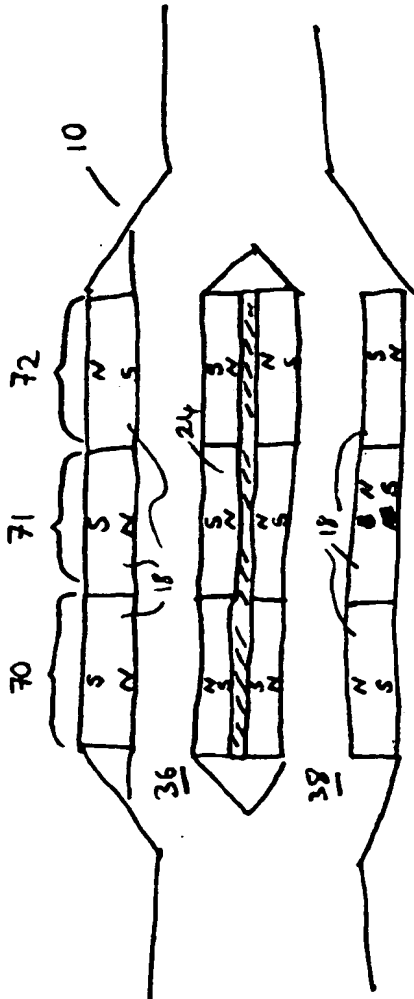


Figure 8B

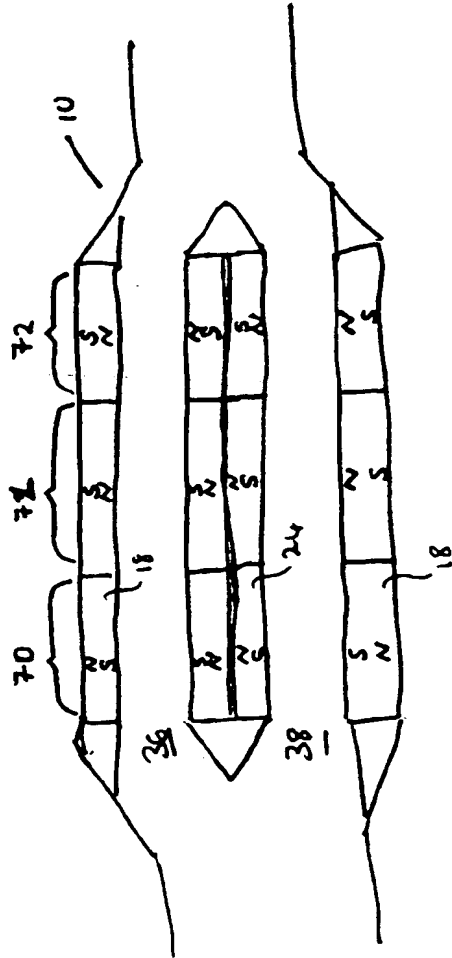
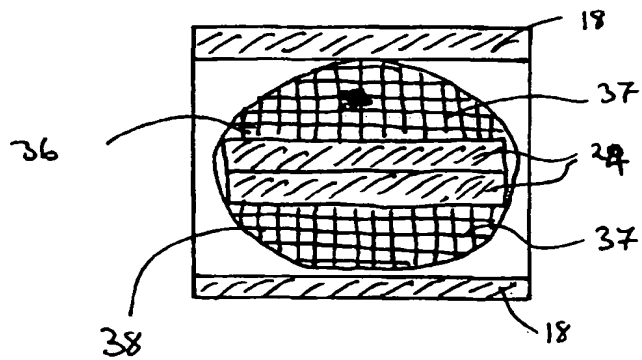
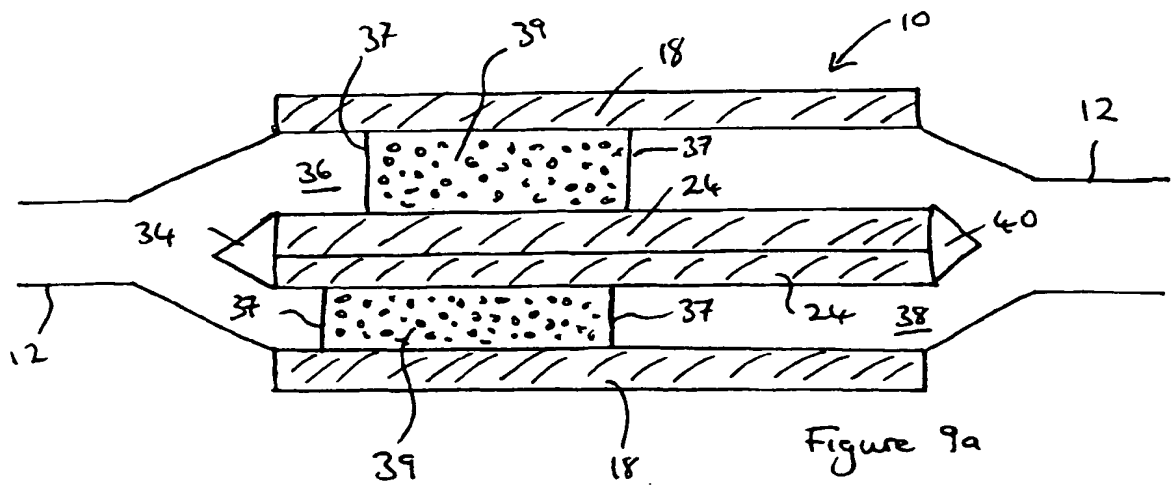
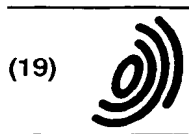


Figure 8C





(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 976 682 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
05.07.2000 Bulletin 2000/27

(51) Int. Cl.⁷: C02F 1/48, F02M 27/04

(43) Date of publication A2:
02.02.2000 Bulletin 2000/05

(21) Application number: 99305988.0

(22) Date of filing: 28.07.1999

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 28.07.1998 GB 9816332

(71) Applicants:
• McClenaghan, Brent
Blackpool, Lancashire FY1 6LY (GB)
• Timms, Nigel
St Annes, Lancashire FY8 2JX (GB)

(72) Inventors:
• McClenaghan, Brent
Blackpool, Lancashire FY1 6LY (GB)
• Timms, Nigel
St Annes, Lancashire FY8 2JX (GB)

(74) Representative:
Chugg, David John et al
Appleyard Lees,
15 Clare Road
Halifax, West Yorkshire HX1 2HY (GB)

(54) Magnetic treatment of fluids

(57) A magnetic fluid treatment device (10) is arranged to be fitted in line with a fuel supply pipe (12) and comprises upper and lower peripheral box sections (14) and (16) respectively into which a plurality of magnets (18) are inserted. The fuel treatment device (10) also comprises upper and lower central box sections (20) and (22), into which further magnets (24) are

inserted. Fuel flowing through the magnetic fuel treatment device (10) on its way to a fuel combustion point or the like is affected by the magnetic fields of the magnets (18) and (24), which results in a more efficient burning process.

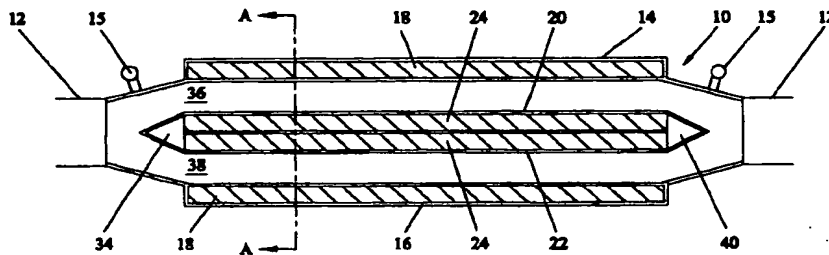


FIG. 1



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 5988

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 104 (M-212), 6 May 1983 (1983-05-06) & JP 58 025561 A (KATSUROU YOSHIMURA), 15 February 1983 (1983-02-15)	1-6,10	C02F1/48 F02M27/04
Y	* abstract *	8,9	
X	US 5 716 520 A (MASON ELMER B) 10 February 1998 (1998-02-10) * column 1, line 17 - line 33 * * column 8, line 12 - line 54; figures 23,24 *	1,2,10	
X,P	WO 98 49103 A (PAVANELLO MARIO ;FELIZIANI ALESSANDRO (IT); MEHLEM LUIGI FILIPPO () 5 November 1998 (1998-11-05) * page 3, line 11 - line 12; figures 2,3 *	1,8,9	
Y	WO 98 02656 A (MORRIS STEVEN ;TRI TECHNICA LIMITED (GB)) 22 January 1998 (1998-01-22) * abstract; figure 3 *	8,9	
X	US 4 999 106 A (SCHINDLER ROBERT H) 12 March 1991 (1991-03-12)	1,10	
Y	* column 2, line 3 - line 8; figure 3 *	7,11,12	F02M C02F
Y	FR 2 706 949 A (BRUOT JACQUES) 30 December 1994 (1994-12-30) * figures 2A,2B *	7,11,12	
X	DE 41 07 512 A (OS BAD ROZWOJOWY GOSPODARKI EN) 10 September 1992 (1992-09-10) * figures 1,2 *	1,4,6	
X	GB 1 048 789 A (T.I.S.VERMEIREN) * figure 3 *	1,10	
	--- -/--		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 May 2000	Examiner Alconchel y Ungria,J
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons - : member of the same patent family, corresponding document</p>			

EPO FORM 1503 01.92 (P04001)

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 5988

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 2 174 146 A (JOHOKU KIGYO KABUSHIKI KAISHA) 29 October 1986 (1986-10-29) * figures 2,3 *	1,10	
X	EP 0 791 746 A (WANG WENHAO) 27 August 1997 (1997-08-27) * figure 5 *	1,10	
A	GB 2 221 173 A (LIFF IND LTD) 31 January 1990 (1990-01-31) * figures 3,5 *	1-12	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	16 May 2000	Alconchel y Ungria,J	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date O : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 5988

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-05-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 58025561 A	15-02-1983	NONE	
US 5716520 A	10-02-1998	AU 4073597 A WO 9807659 A	06-03-1998 26-02-1998
WO 9849103 A	05-11-1998	IT BS970036 A AU 7232798 A	28-10-1998 24-11-1998
WO 9802656 A	22-01-1998	AU 3627397 A	09-02-1998
US 4999106 A	12-03-1991	LU 87289 A AT 76853 T CA 1338537 A DE 68901695 D DE 68901695 T EP 0352213 A GR 3004787 T JP 2068191 A	02-02-1989 15-06-1992 20-08-1996 09-07-1992 25-02-1993 24-01-1990 28-04-1993 07-03-1990
FR 2706949 A	30-12-1994	NONE	
DE 4107512 A	10-09-1992	NONE	
GB 1048789 A		BE 670809 A CH 449530 A DE 1542554 A FI 44888 B FR 1495761 A NL 6513987 A SE 315958 B	31-01-1966 11-06-1970 30-09-1971 20-12-1967 13-04-1967 13-10-1969
GB 2174146 A	29-10-1986	NONE	
EP 0791746 A	27-08-1997	CN 1121560 A AU 3740195 A BR 9510132 A JP 10512640 T AU 695491 B AU 3423995 A CA 2235885 A WO 9612885 A	01-05-1996 15-05-1996 14-10-1997 02-12-1998 13-08-1998 09-05-1996 02-05-1996 02-05-1996
GB 2221173 A	31-01-1990	AU 4043989 A EP 0380644 A WO 9001018 A	19-02-1990 08-08-1990 08-02-1990

EPO FORM P0469

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ BLACK BORDERS

☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES

☒ FADED TEXT OR DRAWING

☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING

☐ SKEWED/SLANTED IMAGES

☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS

☐ GRAY SCALE DOCUMENTS

☒ LINES OR MARKS ON ORIGINAL DOCUMENT

☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY

☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.